A Brief Report on the Workshop on

"Recent Progress In Surface and Volume Scattering"

DAJA45-88-M-0137

at

Institute of Optics
C.S.I.C.
Madrid, Spain

14–16 September, 1988

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This will appear in the December issue of the IEEE Antennas & Propagation Society Newsletter.

GSB
20 Oct 88

On 14 through 16 September of this year, a workshop was hosted by Dr. M. Nieto–Vesperinas at the Institute of Optics of the Spanish High Council of Scientific Investigation (C.S.I.C.) in Madrid, Spain. The sponsors of the meeting were the European Research Office of the U.S. Army, C.S.I.C., and the Spanish Society of Optics. The theme of the workshop was "Recent Progress in Surface and Volume Scattering" and it was attended by twenty–seven scientists and engineers from some thirteen countries. The purpose of the workshop was to bring together researchers from many diverse disciplines to report on and discuss their work related to wave scattering by particulate volumes and rough surfaces.

The common thread in the great majority of the talks was the interest in enhanced backscattering from both volumes and surfaces and its basic causes. The first day presented both experimental and theoretical/numerical work which addressed this problem with randomly rough surfaces. J. C. Dainty's group in the UK has made extensive measurements of rough metallic surfaces (using lasers) which show that there is, indeed. a peak in the backscatter direction for sufficiently large rms surface slope. Furthermore. they have observed this effect with two and three dimensionally rough surfaces. The great majority of the theoretical work appeared to be directed toward the numerical solution of the basic integral equation for the current induced on two–dimensionally rough conducting or dielectric surfaces; these results do show a degree of enhancement. Purely analytical work was less in abundance and it appeared to be more directed toward discovering the physical causes of enhanced backscatter. Some of the questions which came out of this day's discussion and which appeared to need further investigation were as follows:

- the role of single versus multiple scattering in enhanced backscattering,
- the source or root cause of this type of enhancement.
- the relationship of this type of enhancement to Anderson localization effects, and
- the actual level of enhancement that can be obtained.

The second day reviewed some recent techniques which have been developed to deal with two-dimensional surface scattering problems. The major emphasis here was on the use of functional analysis and surface impedance boundary conditions to study the scattering from gratings. There was also a paper discussing the effect of particle roughness on scattering by a random collection of particles. Experiments designed to measure the inner and outer scales of turbulence were discussed along with the application of Devaney's filtered back propagator algorithm to accomplish diffraction tomography. There were very interesting papers delivered on surface modifications by intense laser radiation and third order nonlinear interactions at surfaces and in thin films via Brillouin scattering. Finally, there was a discussion by the Marseille group of enhanced second harmonic generation through delocalized surface plasmon resonance excited by a metallic surface grating.

A very important problem brought out during the second day's discussion was the failure of conventional moment method techniques for surfaces which support plasmons. This is due to the nonlocalized behavior of the surface plasmon as it propagates along the surface.

The last day saw both theoretical and experimental work presented on the enhancement of scattering from a layer of turbulence backed by a perfectly flat reflecting mirror. The analysis proceeds very nicely by treating the turbulence layer as a phase screen and the experiments using laser radiation give clear evidence of the enhancement. The remainder of this session was devoted to scattering by particulate volumes when the density of particles is relatively large. This was a particularly interesting session for the engineers in attendance because it presented a physicist's approach to this very difficult problem. During the session, there were theoretical models and experimental data presented on backscattering enhancement from a random assembly of particles via the mechanism of weak localization. Weak localization occurs when the particle density is too large for single scattering to apply but not so large as to give rise to Anderson or strong localization (which has been observed with scattering by volume coatings such as Barium

Titinate). The major question here appears to be the degree of enhanced backscattering that can be achieved with the weak localization effect. Some researchers argued that it can never exceed two while others disagreed with this factor as a bound.

A conference such as this requires a great deal of effort on the part of the participants if it is to be a success. The effort in this case is not just the work necessary to prepare a paper for delivery but also includes the patience and tenacity to understand and comprehend what researchers in other disciplines are doing on similar problems. It is only with such an effort on the part of the participants that there can be a worthwhile exchange of ideas and results. The attendees at this workshop demonstrated a real willingness to cut through the jargon of specific disciplines and contribute to the overall understanding of the complex issues that were discussed. Consequently, this workshop was a very successful vehicle for exchanging research across disciplinary boundaries.